REMARKS

By the present amendment, claims 1 and 23 have been amended to obviate the examiner's objections thereto and/or to further clarify the concepts of the present invention. In particular, claim 1 has been amended to, among other things, incorporate the subject matter of dependent claim 24 therein. Support for other amendments to claim 1 may be found on page 11, lines 28 to 31, especially line 30, of the originally filed specification. Dependent claim 23 has been amended to conform to the amendments at the entry of U.S national phase and dependent claims 6 and 24 have been canceled. Entry of these amendments is respectfully requested.

In the Office Action, claims 1, 5-18, 20-22, and 24 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 3,360,547 to Wilson et al in view of U.S. Patent 5,652,201 to Papay et al. In making this rejection, the Wilson et al patent was asserted to disclose a series of synthetic ester lubricants containing diesters of 3-methyl-1,5-pentanediol with propionic and hexanoic acids, allegedly corresponding to those of claims 1, 5 and 6. However, it was acknowledged the Wilson et al patent fails to teach (i) the addition of a phenol or amine antioxidant to the composition as required by claim 1; (ii) adding the phosphorus-based compound of linear monocarboxylic acid of claims 16-19; iii) adding the benzotriazoles-based or gallic acid-based compounds of claims 20-23;, and (iv) the viscosity of the lubricating composition as required by claim 24.

It then was asserted that the Papay et al patent teaches that lubricating compositions can contain antioxidants, including phenolic and/or amine antioxidants. In addition, the patent was alleged to teach or suggest the deficiencies (ii) to (iv) above. It was concluded that it would have been obvious to the skilled person at the time of the invention "to include the additives of the Papay et al patent in the composition of Wilson et al patent in order to inhibit oxidative degradation of the lubricant, inhibitor wear of the lubricated surfaces, and to inhibit corrosion of the surfaces."

In addition, dependent claims 16-19, which require specific fatty acids, e.g., n-tetradecanoic, n-hexadecanoic, and n-octadecanoic, were rejected under 35 U.S.C. 103(a) based on the Wilson et al and Papay et al publications as applied above, further in view of U.S. Patent No. 2,281,676 to Cook. It was asserted that the latter patent discloses lubricating compositions containing, as antiwear agents, phosphorous compounds (tricresyl phosphate) or aliphatic linear monocarboxylic acids (linoleic acid) that are the same as (c) component recited in the noted claims. It then was concluded it would have been obvious to include the agents of the Cook patent in the composition according to the Wilson et al and Papay et al publications.

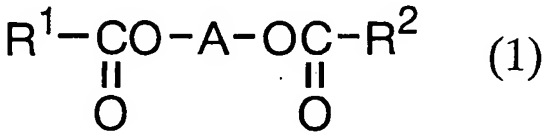
Also, claims 20-23, which require gallic acid-based corrosion inhibitors, were rejected under 35 U.S.C. 103(a) based on the Wilson et al and Papay et al publications as noted above, further in view of U.S. Patent No. 3,790,478 to Rudston. It was asserted that

the latter patent discloses lubricating compositions containing alkyl gallates as corrosion inhibitors where a lubricant is used in lead-containing engines and further teaches the lubricant can be a synthetic ester-based lubricant. It then was concluded that it would have been obvious to one skilled in the art to include the gallate corrosion inhibitors of the Rudston in the compositions of the Wilson et al and Papay et al, in order to inhibit lead corrosion.

Reconsideration of these rejections in view of the above claim amendments, the attached Declaration and the following comments is respectfully requested.

Before discussing the rejection in detail, a brief review of the presently claimed invention may be quite instructive. As is now recited in amended claim 1, the invention relates to a lubricating oil for bearings which comprises:

(a) a diester represented by General Formula (1)



(1)

wherein R^1 and R^2 are the same or different, and each represents a C_6-C_9 linear alkyl group; A represents a monoalkyl substituted liner alkylene group, and the total number of

carbon atoms of the alkyl group and the linear alkylene group is 4 to 6; or a mixture of the diester and an additional base oil, and

(b) at least one member selected from the group consisting of phenol-based antioxidants and amine-based antioxidants. It is a feature of the subject lubricating oil that the lubricating oil has a kinematic viscosity at 40°C of 5-10 mm^2/s and a kinematic viscosity at 0°C of 15-40 mm^2/s.

The subject lubricating oil for bearings is particularly adapted as a lubricating oil for oil impregnated sintered bearings or fluid dynamic bearings used in motors for automotive use (electrical components), home appliances, computers, mobile telephones and the like. It is desirable that such a lubricating oil for bearings have the following properties:

excellent heat resistance,

applicability over a wide temperature range,

excellent lubricating ability, and

absence of influence on the bearing materials themselves (metal compatibility).

Among these, considerable importance is placed on heat resistance due to large temperature elevation caused by increased loads on bearings as set forth on page 1, line 35 to page 2 line 7 of the originally filed specification. It is submitted that such a lubricating oil for bearings is not taught or suggested by the cited patent publications to Wilson et al

and Papay et al whether taken singly or in combination.

More particularly, the patent to Wilson et al apparently discloses a lubricating oil containing, as an essential component, a highly specific compound, that is polyesters of tetraalkylcyclobutanediol as is set forth in column 1, line 41 to column 2 line 15. Furthermore, at column 3 lines 55-70, the Wilson et al patent discloses polyesters of tetraalkylcyclobutanediol as a minor component, and various esters, diesters, and triesters as major components. In addition, the patent appears to disclose diesters of 3-methyl-1,5-pentanediol with hexanoic acid (i.e., C_6 fatty acid).

In distinct contrast, the lubricating oil as defined by amended claim 1 is characterized by comprising a diester of a member selected from C_7-C_{10} saturated aliphatic linear monocarboxylic acids. While the Wilson et al patent apparently discloses 2-ethyl hexanoic acid, it is to be noted that this is a linear acid, and therefore greatly differs in structure from the diester of the presently claimed invention.

With regard to the second rejection set forth above, the Cook patent at column 3, lines 10-13 teaches saturated fatty acid addition agents as corrosion inhibitors in "light turbine oil of 150-160 vis. at 100°F" whose mineral oils are exposed to steam condensate. Among other things, the Cook patent provides no incentive to add the fatty acid corrosion inhibitors to the low viscosity synthetic oil-based lubricants of the presently claimed

invention.

Similarly, with regard to the third rejection set forth above, the Rudston patent was only cited as allegedly teaching the inclusion of gallate corrosion inhibitors in the compositions according to the Wilson et al and Papay et al publications, in order to inhibit lead corrosion. While such lead corrosion would be expected in automotive power applications, it is submitted that such would not be expected in applications of low viscosity bearing lubricants according to the presently claimed invention. Consequently, there would be no incentive to add gallate corrosion inhibitors to the compositions of the previously cited publications.

In support of the position of applicants that the presently claimed invention is not taught or suggested by the cited patent publications, attention is directed to the attached Declaration of Mr. Yasuyuki Kawahara, one of the inventors of the subject application. As detailed in the Declaration, Experiments I and II were conducted to compare the lubricating oils of the presently claimed invention with the lubricating oil obtained by combining the diester (diesters of 3-methyl-1,5-pentanediol with hexanoic acid) of the Wilson et al patent and the agent/additive disclosed in the Papay, Cook and/or Rudston publications. The results of Experiments I and II as set forth in the Declaration are described in the following.

Experiment I

First, a lubricating oil 1, which was made only of diester (diesters of 3-methyl-1,5-pentanediol with hexanoic acid) disclosed in the Wilson et al patent was tested for various required properties of a lubricating oil as set forth in Table I of Declaration. This Table I shows that lubricating oil 1 has a significantly large friction coefficient. As for heat resistance, lubricating oil 1 shows a large evaporation amount, and therefore cannot be tested for its metal compatibility.

Second, lubricating oils 2 to 4 were prepared by mixing a diester disclosed in the Wilson et al patent and agent/additive disclosed in the Papay et al, Cook or Rudston publications (additives (b) to (d) of the present invention), so as to produce oils identical to the oils of Examples 2 to 4 of the disclosed invention, except for the diester. The resulting oils were examined for various required properties of a lubricating oil as is also set forth in Table I of Declaration.

A comparison of lubricating oils 2 to 4 (made of components identical to those of Examples 2 to 4, except for the diester) with oils of these Examples showed a 37.6 to 38.3% evaporation amount during a heat resistance test for the former, whereas, the lubricating oils of Examples 2 to 4 showed an evaporation amount of 5.3 to 5.8 % during the heat resistance test. The lubricating oils of Examples 2 to 4 are thus significantly

superior in heat resistance.

Experiment II

In Experiment II, antioxidant B: 2,6-di-t-butyl-p-cresol was used instead of antioxidant A: 4,4'-methylenebis-2,6-di-t-butylphenol used in lubricating oils 2 to 4 and the lubricating oils of Example 2 to 4 of Experiment 1. Then, the lubricating oil properties were tested in the same manner.

Lubricating oil 5 was prepared with the same composition as that of the oil of Example 10, except that diesters of 3-methyl-1,5-pentanediol with n-hexanoic acid was used instead of diesters of 3-methyl-1,5-pentanediol with n-heptanoic acid and n-octanoic acid. Then, the lubricating oil properties were examined in the same manner as is set forth in Table II of Declaration. Further, lubricating oils 6 and 7 were prepared with the same composition as that of the oil of Example 10, except that diesters of 3-methyl-1,5-pentanediol with n-hexanoic acid, and additives (c) or (d) were used as described in Table II of Declaration.

Lubricating oils 5 to 7 showed an evaporation amount of 69.5 to 70.4% according to a heat resistance test, whereas, the lubricating oil of Example 10 showed an evaporation amount of 32.8% according to the heat resistance test. The lubricating oil of Example 10

is thus significantly superior in heat resistance.

It is submitted that the above-noted differences as demonstrated by the Declaration are significant. The lubricating oil for bearings used for various motors, once supplied, is generally used for the entire life of the device with no extra oil being added. In view of this requirement, an oil having a low heat resistance does not ensure the long-term, stable use of a device, as the oil will vaporize quickly.

As shown from the results of Experiments I and II, the lubricating oils according to the amended claims are superior in the required characteristics for lubricating oils for bearings, particularly in heat resistance, than the lubricating oils taught by the combination of Wilson et al patent and secondarily cited publications. In view of the foregoing, it is submitted that the Wilson et al patent and the other cited publications do not disclose or suggest the use of the diester represented by the general formula (1) of the present invention, and the excellent effects of the lubricating characteristics, particularly in heat resistance, given by the diester.

Furthermore, the lubricating oils for bearings as presently claimed require a "low viscosity over a wide temperature range and low friction." This particular feature is now specifically recited in claim 1 by the incorporation of the viscosity recitations from prior claim 24.

As earlier noted, the Wilson et al patent is silent respecting viscosity for the disclosed compositions. The Papay et al publication teaches introducing its additive in amounts that vary "in accordance with such factors as the viscosity characteristics of the base oil or fluid employed, the viscosity characteristics desired in the finished product, the service conditions for which the finished product is intended, and the performance characteristics desired in the finished product" as is set forth in column 49, line 66 to column 50, line 5. However, the Papay et al publication fails to suggest low viscosity bearing lubricants of the present invention. Indeed it teaches incorporating its additives only "in lubricating oil and functional fluid compositions, such as automotive crankcase lubricating oils, automatic transmission fluids, gear oils, hydraulic oils, cutting oils, etc." as disclosed at column 47, lines 52-55, which are not applications for low viscosity lubricants.

For the reasons stated above, withdrawal of the rejections under 35 U.S.C. § 103(a) and allowance of claims 1, 5 and 7-23 as amended over the cited patent publications are respectfully requested.

In view of the foregoing, it is submitted that the subject application is now in condition for allowance and early notice to that effect is earnestly solicited.

In the event this paper is not timely filed, the undersigned hereby petitions for an appropriate extension of time. The fee for this extension may be charged to Deposit

Account No. 01-2340, along with any other additional fees which may be required with respect to this paper.

Respectfully submitted,

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Enclosure: Declaration of Yasuyuki Kawahara